On the Biology of Diplococcus intracellularis: SIMON FLEXNER.

The Stability of Tetanus Toxin: M. J. ROSENAU.

Some Observations on the Blood of Horses: J. J. KINYOUN.

The Alleged Rôle of Intestinal Worms as Inoculating Agents in Typhoid Fever: C. W. STILES.

The Absorption of the Third Serum Component: W. H. MANWARING.

The So-called Physical Chemistry of Hemolytic Serum: W. H. MANWARING.

On the Chemical Inactivation and Regeneration of Complement: HIDEYO NOGUCHI.

On the Electric Charge carried by Toxins, Antitoxins and Agglutinins: C. W. FIELD.

An Improved Technic for Tuberculo-opsonic Preparations: A. P. OHLMACHER.

Some Suggestions concerning the Terminology of Opsonic Theory and Practise: A. P. OHLMACHER.

The Generic Characters of the Coccaceæ: C. E. A. WINSLOW and Miss A. F. ROGERS.

Actinomyces of the Oral Cavity: D. H. BERGEY.

Program of the Third Session, December 29, 1906

(Joint meeting of Section K and the American Physiological Society.)

The Functions of the Ear of the Dancing Mouse: R. M. YERKES.

The Effect of Section of One Vagus upon the Secondary Peristalsis of the Esophagus: S. J. MELTZER and JOHN AUER.

On the Alleged Adaptation of the Salivary Glands to Diet: F. P. UNDERHILL and L. B. MENDEL.

Adaptation of Saliva to Diet: C. H. NEILSON.

The Effect of Phosphorus Starvation on Aspergillus niger: WALDEMAR KOCH and H. S. REED.

New Chemical Facts about Tendon and Compound Proteins: WILLIAM J. GIES.

A Further Study of Peptolysis: W. N. BERG and WILLIAM J. GIES.

The Action of Blood Serum and Tissue Extracts on the Coagulation of the Blood: LEO LOEB.

Some Observations on the Esophagus after Bilateral Vagotomy: W. B. CANNON.

Concerning the Pharmacological Action of Salicylic Acid: L. B. STOOKEY and M. MORRIS.

A Nuclein Metabolism Experiment on a Dog with an Eck Fistula: P. A. LEVENE and J. E. SWEET.

Protein Analysis: P. A. LEVENE, W. A. BEATTY, D. R. MACLAURIN and C. H. RUILLER.

A Demonstration of Normal Gastric Peristalsis in the Rabbit: JOHN AUER.

Peristalsis of the Rabbit's Cecum (with demonstration): JOHN AUER and S. J. MELTZER.

Preservation of Blood Vessels in Cold Storage: ALEXIS CARREL.

Demonstration of Failure of Regeneration of the Cervical Ganglion Twenty-six Months after its Removal: S. J. MELTZER.

WILLIAM J. GIES,
Secretary

SCIENTIFIC BOOKS

THE TERRACES OF THE MARYLAND COASTAL PLAIN

Maryland Geological Survey. Pleiocene and Pleistocene. Baltimore, 1906. Pp. 291, plates and maps.

The high standard of investigation and publication reached in the previous reports of the Maryland Geological Survey under the direction of Professor W. B. Clark is maintained in the recent volume on the 'Pleiocene and Pleistocene of the Coastal Plain'; the later physical history of the district being treated by G. B. Shattuck, recently of Johns Hopkins University, now professor of geology at Vassar College, while its paleontology is discussed by Clark, Lucas, Hollick and other experts. The chief physical results of this elaborate study, already outlined by Shattuck six years ago ('The Pleistocene Problem of the North Atlantic Coastal Plain,' Johns Hopkins University Circulars, No. 152, 1901), concern the marine terraces that have been carved on the slopes of the previously dissected coastal plain, and are presented in the first half of the report under such headings as general stratigraphic relations, physiography of each terrace, structure of each terrace, method of interpretation, resulting inferences as to geological history, and summary. The chapters on paleontology include a general account of the Pleistocene fauna by Clark, and flora by Hollick; then a discussion of systematic paleontology under ten headings from mammalia to spermatophyta by various authors, and a special chapter on the elephants of the Pleistocene by Lucas. So detailed a treatment of Pleistocene paleontology is novel in American geological reports.

The geological history of the region to which this review is directed, may be briefly summarized as follows: The series of marine strata, chiefly Cretaceous and Tertiary, which make up the body of the Maryland portion of the Atlantic coastal plain, was uplifted and perhaps nearly baseleveled by subaerial erosion, in time to receive, when again submerged, a broad sheet of Lafayette (Pleiocene) gravels and sands. Another uplift again exposed the coastal plain, thus renovated, to prolonged erosion under the leadership of the Potomac, Susquehanna (Chesapeake), and other large rivers, the main valleys thus gaining an expression of advanced maturity, with depth and breadth perhaps not far short of the dimensions which they now possess. Next came a strong depression; the mature valleys were drowned and a well-defined shore-cliff or scarp was cut on their slopes (the stage of development reached by the shore line being inferred by the reviewer to have been advanced youth or early maturity). Sunderland is the name given to this scarp and to the associated marine terrace deposits then formed. A series of short-lived partial uplifts and slight depressions followed; each uplift permitting a renewal of dissection on the emerged slopes; each depression sufficing to produce a new scarp with a submarine terrace. Three sets of scarps and terraces below the Sunderland were thus formed; the Wicómico, the Talbot and the Recent; all, like the Sunderland, contouring around the frayed-out slopes of the dissected coastal plain, and now standing at altitudes of (about) 200, 100, 40 and zero feet.

This interpretation has two chief bases. First, a critical study of the features along the present shore line; second, a comparison of these features with similar features at higher levels. The work has every appearance of being carefully done. It will be interesting to note how far the conclusions are supported by new studies, either of a more detailed character in Maryland, or of a broader character in neighboring states.

An understanding of the development of the present shore line is evidently of fundamental importance. It is shown to have followed a moderate submergence of the previously dissected coastal plain. The very irregular initial shore line thus produced has been systematically modified by the development of long, off-shore sand reefs on the most exposed ocean front, while scarps have been cut on the headlands of the less exposed bays, and short sand reefs have frequently been thrown across the smaller reentrants within which deltas and marshes have accumulated. At the same time a submarine terrace of gravels, sands and clays is believed to have been formed for a certain distance off shore. At various points where the headland scarps are cut back, the neighboring sand reefs have been forced to retreat at about the same rate; and thus the inner border of the stratified terrace

deposits, containing marine fossils, is believed to be locally superposed upon the fresh-water or brackish-water sands and clays of the delta and marsh reentrants. The base-line of the scarps, the surface of the delta plains, and the inner border of the marine terrace are all closely at the same level. The scarps rise sharply above their base line, and gain a height dependent on the altitude of the headland in which they were cut; the terraces slope very gently waterward, their layers resting unconformably on the submerged and eroded land-surface, and their composition and thickness presumably varying with local changes of depth, waves and currents.

It is the occurrence, at various altitudes above sea-level, of features similar to those of the present shore line, but now more or less wasted by erosion, that has led Shattuck to his ingenious interpretation of the Sunderland, Wicómico and Talbot terraces. He traversed the coastal plain in all directions, but not until it occurred to him to explain its details of form and structure by means of marine action at several levels was it possible to bring order out of confusion. The scarps, especially the higher earlier ones, are dulled by weathering; and the terrace fronts are dissected by retrogressive streams, especially where undercut by the next lower scarp. Nevertheless they are still traceable. It is significant that the correlation of the different parts of each terrace is usually not based on paleontological evidence, for most of the deposits do not bear fossils; nor on diversity of composition, for the materials of the successive terraces are all much alike in their variable nature; but chiefly on the continuity and similarity of surface form and deposits, when traced horizontally in various districts; and on the systematic sequence of forms and deposits, when followed down from higher to lower levels. The plane, marked by the inner border of each terrace, must have been horizontal when formed, and is now faintly inclined to the southeast, as a result of slight inequality in later elevatory movements. The Talbot terrace, next preceding the present, has still a practically level inner border; the Sunderland terrace, having felt all the later changes of level, summarizes their inequality in a seaward slope of about three feet to a mile. Much more distinct than these extremely faint slopes is the manifest though still gentle descent of each terrace as it departs from its inner border at the scarp base towards the larger valleys with which it is related.

The maps that are bound in with the report give it excellent illustration. First is a general map of eastern Maryland (1,500,000), showing all the formations here described; and from this it appears clearly that, if the Lafayette, and Sunderland ever existed (as they probably did) on the eastern peninsula of Maryland and Delaware—the 'Eastern Shore'—they were removed by successive attacks of subaerial and marine erosion, thus allowing the Wicómico terrace to spead over the axial upland of the peninsula as a broad plain, as yet but little dissected over its medial area. It is only on the group of dissected peninsulas between the Chesapeake and Potomac that the whole series of formations can be found, descending step-like from Lafayette on the uplands to Recent at the shore line. The inferred relations of land and water at successive epochs are even more clearly shown on a series of four smaller maps (20 miles to an inch), illustrating the supposed areas of submergence in Lafayette and later times. A final map indicates the inferred emergence of the land and the extended rivers of the Talbot-Recent interval of uplift. Numerous plates give views of the terrace deposits and of the scarps, recent and abandoned.

A brief review of certain points, on which this excellent report is not altogether clear at first reading, may now be presented.

1. As to the stage of erosion of the Cretaceous-Tertiary coastal plain, that had been reached when depression occurred and the deposition of the Lafayette commenced. It is said that "there was a long interval of erosion before deposition of the Lafayette beds began" (p. 78), and that "the Lafayette was developed as a plain surface sloping gently toward the surrounding waters" (p. 123); but the stage of erosion reached in pre-Lafayette time is not explicitly stated in physiographic

terms. However, the smoothness of the Lafayette plain, where it is still preserved, taken with the moderate thickness of its deposits (50 or 100 feet), would indicate that great advance had been made toward base-leveling by pre-Lafayette subaerial erosion; and that whatever residual relief then survived on the Cretaceous-Tertiary coastal plain area was effectually abraded by the advancing Lafayette sea. This conclusion evidently postulates the marine origin of the Lafayette, an origin generally accepted and not here brought into question.

2. The stage of erosion reached in the Lafayette-Sunderland interval of uplift. A comparison of statements in different chapters of the report and an examination of the relation between the several terrace scarps and the main valleys lead the reviewer to infer that the uplift of the renovated, or Lafayette-covered coastal plain was sufficient in amount and duration to allow its erosion by normal, river-led processes in the Lafayette-Sunderland interval to a stage of advanced maturity. The valleys thus formed seem to have compared well in width and depth, as stated above, with those of the Potomac and Chesapeake of the present day. The text of the report is, however, not immediately clear on this important point; and this is the more to be regretted, because a definite physiographic picture of the district at the beginning of the strong depression which culminated in the erosion of the Sunderland scarp is an essential basis for a clear understanding of the development of the several terraces. The difficulty here seems to be that the problem of the Lafayette-Sunderland interval is not completely stated on an early page, and then referred to, when occasion again arises, in the terms first adopted for its description; but that it is stated partially in different chapters, in various connections, and in diverse terminology, through all of which the reader must pursue his inquiry before he can acquire the writer's point of view. For example, after reading (as quoted above) that "there was a long interval of erosion before deposition of the Lafayette beds began," the following lines state that 'another long period of erosion occurred' before the Sunderland terrace was formed (p. 78). This would naturally give the impression that the Lafayette-Sunderland erosion interval was of great importance, for the pre-Lafayette erosion went far towards base-leveling the coastal plain of earlier uplift. On the other hand, in the final summary, the 'elevation and erosion' between the Lafayette and Sunderland formations is stated in precisely the same terms as the 'elevation and erosion' between each pair of the succeeding formations (p. 137); and inasmuch as the later erosion intervals are well proved to have been of moderate duration (as will be shown below), this would suggest that the Lafayette-Sunderland interval was also of no great length. The reader who glances, as some readers may, over the closing summary of the report before reading the details of the preceding pages, will naturally gain from the summary an impression that all the post-Lafayette erosion intervals were of about the same length. But this impression would have to be changed on further reading. For example, it is stated on an earlier page: "The salient features of the Coastal Plain topography were outlined at this time [Lafayette-Sunderland interval], although it is doubtful if they received their full strength or final touches before the post-Talbot uplift" (p. 123). This would indicate that the interval under discussion was long enough for the attainment of a mature stage of erosion; yet the next earlier sentence states: "After the deposition of the Lafayette formation, the land was raised above ocean-level and subjected to an interval of erosion which was probably of longer duration than the later ones which separated the other surficial deposits [terraces] of the series" (p. 123). Here the phrase, 'probably of longer duration' destroys all the emphasis that might be given to the duration of the Lafayette-Sunderland interval by the previous citation. Again, the statement that the Sunderland formation "extends up into ancient valleys which penetrate it [the Lafayette] as reentrants" (p. 87), coupled with the fact that these reentrants are shown by the general map to stand on the opposite sides of larger valleys,

five or ten miles wide, gives good ground for the inference that advanced maturity of erosion had been reached before Sunderland deposition began; and this inference is confirmed on reading a little later: "It is evident that the valleys of the Potomac, Patuxent and other large rivers as well as that of Chesapeake Bay existed [before Sunderland deposition], since the Sunderland formation, which was deposited when this topography was submerged, slopes toward all these depressions" (p. 123). Yet the next sentence baffles the reader by referring to the pre-Sunderland valleys as 'gorges,' a term which suggests something very different from valleys several miles wide and only a few hundred feet deep, with gentle lateral slopes of semi-consolidated formations, and which implies a relatively brief erosion interval. The reader's mind would surely be more easily made up regarding the writer's idea of the sequence of events, if the important Lafayette-Sunderland erosion interval had been once for all effectively described in technical language in an early chapter, and afterwards referred to when necessary in essentially the same language as that first employed.

The depth of the valleys eroded in the Lafayette-Sunderland interval is believed by Shattuck to have been less than that of the present valleys; but the evidence presented in favor of this conclusion does not seem to be positive. That valleys were present when the Sunderland terrace deposits were formed is shown by the fact that the deposits slope "from the watersheds of the peninsulas of southern Maryland toward Chesapeake Bay on the one hand and the estuaries of the Potomac and Patuxent rivers on the other" (p. 115). But it is concluded that no valley was cut so deep as it is now, because the Sunderland formation "nowhere shows a tendency to develop a thickness sufficient to fill such a valley" (p. 123; see also p. 135). The same is stated to be true of the other terraces (p. 135). It is not altogether safe for one who has but a slight acquaintance with the district under discussion to oppose this conclusion; yet the argument by which it is supported does not appear to be fully convincing. The comparatively brief duration of marine action at the several terrace levels would seem to be compatible with the deposition of most of the marine terrace sediments not far from the shore line, particularly in view of the belief that the scarps were presumably cut and the terraces built for the most part during a time of continued depression. Moreover, if the main valleys had been significantly deepened during the later inter-terrace intervals by normal subaerial agencies under the leadership of the larger rivers, the valleys must have also been greatly widened during the same intervals; and the time required for such widening —a slow process—seems inconsistent with the fairly good preservation of the first-made (Sunderland) scarp. This leads to a consideration of a third topic.

3. The duration of the interterrace intervals. The fact that the weathered Sunderland scarp is now recognizable at all requires that the entire duration of post-Sunderland time can not have been a large part of a physiographic cycle. Such a scarp, a minor feature at the best, would be entirely destroyed by general subaerial erosion in the passage of a coastal plain from the stage of late youth to that of early maturity, or from early maturity to late maturity. Hence only a short duration can be allowed to each of the three inter-terrace intervals of uplift and erosion, as well as to each of the three intervals of scarp-cutting and terrace-depositing. The author recognizes that these intervals are comparatively short, but he does not give sufficient emphasis to the contrast between their shortness and the much greater length of the Lafayette-Sunderland erosion interval. The work done in cutting scarps and depositing terraces is, however, very clearly presented; naturally so, as this is the chief theme of the report. The manner in which the later terrace deposits extend into the reentrants eroded in the margins of the earlier terrace deposits gives good proof that the post-Sunderland movements were oscillations; that is, repeated partial uplifts separated by slight depressions; and not merely pauses in a persistent uplift. The way in which the marine sands have come to overlie the fresh- or brackish-water bay-head clays is

admirably analyzed and illustrated. It is true that by no means all of the deposits which are treated as of marine origin are known to contain marine fossils; yet the localities where marine fossils have been found in them are held to be of demonstrating value for many others. With all these points in mind, one may picture very clearly the rapid succession of short-lived events during the Sunderland depression and the later oscillations. The advancing Sunderland sea presumably shaved off a film from the sinking surface; and the thickness of the film increased to a measure of fifty or more feet when the greatest encroachment of sea on land was made during the pause which closed the depression. In the following partial emergence, the sea presumably withdrew without doing recognizable erosive work —much in the way that the tool of a planing machine backs harmlessly across an iron plate, preparatory to taking off a shaving in its next advance. But the extended streams and rivers took advantage of the withdrawal of the sea and eroded new valleys in the margins of the revealed terraces. The advances of the sea in Wicómico and Talbot times repeated the operations of the Sunderland advance; and the recent advance, now in operation, gives the key to its predecessors.

The paleontological pages of the report show that the terraced coastal plain was a forested region during the time of its oscillations, with many trees like those of to-day; and that mammoths and elephants were among its inhabitants. Nearly all the marine forms are found living along the present coast.

Although this report is elaborated far beyond any previous descriptions of the Maryland coastal plain, there are certain features to which detailed studies may still be profitably directed in the future. There is, of course, a continual watch to be kept for new localities where sections of the various terraces may be exposed, and particularly where fossils may be found. All such discoveries will have high value in testing the correctness of the conclusions now set forth, inasmuch as the capacity of a theory reasonably to account for facts of later discovery is one of its best recommendations. Moreover, there are certain physiographic details to be filled in, which will give increased verisimilitude to the pictures of the Maryland Pleistocene already drawn. These details have regard to the contrasts that may be expected between the shore lines of the exposed ocean front and of the protected bay borders. For example: in Sunderland time, the peninsula of the Eastern Shore was completely submerged; the western border of what is now Chesapeake bay must then have been beaten with breakers from the ocean swell—except in so far as the swell was expended in passing over the shoals of the submerged Eastern Shore. The Sunderland scarp thus formed should have a different outline from the Wicomico, Talbot and Recent scarps, lower down the west Chesapeake slope; for when the latter scarps were formed, Chesapeake bay was enclosed from the ocean by the Eastern Shore peninsula, and its limited waves could not have trimmed a shore line of the same expression as that made by the ocean breakers. Similarly, the Talbot scarp cut in the Wicomico terrace on the eastern side of the Eastern Shore must have been cut by ocean breakers similar in force to those which have in Recent time formed the long, smooth-curved, off-shore sand reef by which Chincoteague and other 'bays' are enclosed along the present ocean front. Hence a similar off-shore sand reef might have been formed in a similar situation during the Talbot epoch. As no such Talbot sand reef is described, the reader is left somewhat in doubt as to whether it is really absent or whether exploration on the farther (eastern) slope of the Eastern Shore was not carried out in sufficient detail to determine it. Again, it is noted that the scarp and terrace of one epoch are occasionally undercut and entirely destroyed by the undercutting of the scarp of the next succeeding epoch; just as might be expected if the general slope of the attacked surface had been somewhat steeper in the later than in the earlier epoch. It will be interesting to learn if independent evidence is eventually found to show that such was the case. Finally, there are certain local features of special significance

found at a few points on the present shore line, such as the cuspate forelands seen at Cedar and Cove points on the lower Chesapeake; it will be edifying to learn if similar details are revealed by further study of the earlier shore lines. All these details concerning the shore line features might, it may be noted, have been stated to advantage in a technical terminology, as expressive of the precise quality of the facts as is the technical terminology that is employed without hesitation in the chapters on paleontology; but in the present volume the best technical terminology for the descriptions of shore lines—that suggested by Gulliver—is unfortunately seldom employed.

There is one reflection that Shattuck's close study of a coastal plain suggests to one who is particularly interested in that class of forms as objects of physiographic study; namely, the difficulty of telling the whole truth in a brief statement. It is customary with some physiographers to describe the coastal plain of the Maryland region as having been formerly maturely dissected and recently partly submerged; an effective general picture of its present form and outline is thus suggested in a few words. But the details of its form require a more elaborate statement for their proper presentation. It is a coastal plain which, having been uplifted and effectually baseleveled, was renovated with a wide-spread cover of Lafayette sediments, and then uplifted again, as good as new: in this condition it was dissected to well advanced maturity; then strongly submerged preparatory to an oscillating emergence, which allowed the rapid carving of four scarps and the deposition of four terraces (the last being those of to-day) on its maturely dissected slopes. The first brief statement will serve for use in schools; the second more elaborate account, with appropriate local details, may suffice for use in colleges. The features yet to be more fully investigated offer fitting subjects for field research by graduate students and professional workers.

W. M. DAVIS

SOCIETIES AND ACADEMIES

THE TEXAS ACADEMY OF SCIENCE

THE first meeting of the Texas Academy of Science for the year 1906–'07 was held in the chemical lecture room of the University of Texas on Friday evening, October 26, 1906. The program consisted of the inaugural address of the president, Dr. S. E. Mezes, professor of philosophy in the university and dean of the college of arts, who took for his subject 'What is Matter?'

At the regular meeting, November 24, 1906, Dr. George S. Fraps, of the Agricultural and Mechanical College of Texas, state chemist, discussed 'Food Adulteration' after which the speaker was entertained by the officers of the academy at an informal banquet.

The semi-annual formal meeting was held Tuesday evening, December 26, 1906. Dr. H. Y. Benedict, professor of applied mathematics and astronomy, in the University of Texas, delivered an illustrated lecture on 'The Solar System.'

At the regular meeting of January 26, 1907, Captain T. J. Dickson, chaplain of the 26th Infantry, U. S. A., Fort Sam Houston, San Antonio, by request, presented two illustrated papers: (1) 'Fighting Asiatic Cholera,' (2) 'The First Ascent of Mount Isarog'; both papers dealing with his personal experiences in the Philippine Islands.

The meeting for February–March was held March 7, 1907. Dr. Eugene P. Schoch, adjunct professor of chemistry, University of Texas, gave an experimental exhibition of 'The Transformation of Radium.'

Volume VIII. of the *Transactions of the Academy* has been recently published. Its contents include papers on the following subjects:

'The Æsthetic Element in Scientific Thought,' by Dr. Thomas Montgomery, Jr. This is the presidential address for 1905.

'Paving Brick,' by Thomas U. Taylor, dean of the department of engineering in the University of Texas.

'The Spacial Conception of the Blind,' by Dr. Franz J. Dohmen, honorary lecturer in mathematics in the University of Texas.